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EXAMINER	
PARK, EDWARD	
ART UNIT	**PAPER NUMBER**
2609	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/790,506	FERON, ERIC	
	Examiner	Art Unit	
	Edward Park	2609	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/26/04, 7/13/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. **Claim 28** is objected to because of the following informalities: It is apparent that claim 28 consists of two independent claims. It would appear this is a typographical error made by the applicant. Hence, the second independent claim ("A method of determining ....") will be referred to as claim 28a for examination purposes. Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. **Claims 1, 2, 3, 4, 5, 6, 14, 15** are rejected under 35 U.S.C. 102(b) as being anticipated by Muller et al (US 5,886,781).

Regarding **claim 1**, Muller teaches an object positioning and attitude estimation system, comprising:

a grating assembly associated with a reference location, which generates a fringe interference pattern ("means comprise at least one pair of moiré gratings spaced from each other"; Muller: col. 2, lines 1-2);

a viewer mountable on an object for capturing an image of a fringe pattern generated by the grating assembly ("at least one camera or observation means"; Muller: col. 2, lines 15-24); and

a processor in communication with the viewer for measuring the generated fringe pattern ("programmable central unit"; Muller: col. 2, lines 15-24) and, based thereon, determining the orientation of the object relative to the reference location ("computing the independent angles permitting defining the position of each element"; Muller: col. 6, lines 23-25).

Regarding **claim 2**, Muller teaches a grating assembly comprising at least two planar gratings in a fixed spatial relationship to each other (Muller: figure 3a).

Regarding **claim 3**, Muller teaches a grating assembly includes gratings of different properties ("substantially parallel ... angle relative to each other ... for fine angular measurement .. for absolute angular measurement"; Muller: col. 2, lines 6-15).

Regarding **claim 4**, Muller teaches a grating assembly further comprises a light source (Muller: figure 10, numerals 24, 25).

Regarding **claim 5**, Muller teaches a visible light source (Muller: figure 10, numerals 24, 25).

Regarding **claim 6**, Muller teaches grating assembly relies on ambient light (Muller: figure 10, numerals 24, 25).

Regarding **claim 14**, Muller teaches a viewer comprising a camera (Muller: figure 10, numerals 26-27).

Regarding **claim 15**, Muller teaches an image processor that determines the orientation of the interference pattern, determines the distance to the pattern emitter, and extracts the phase of the interference pattern (Muller: figure 10, numeral 28).

4. **Claims 16, 26, 27, 28, 28a** are rejected under 35 U.S.C. 102(b) as being anticipated by Greivenkamp, Jr. et al (US 5,075,562).

Regarding **claim 16**, Greivenkamp teaches a method of determining position relative to a interference pattern generator, comprising capturing an image of an interference pattern from a known fringe pattern generator with a viewer (Greivenkamp: figure 7, numeral 66); determining the phase of the interference pattern with a processor (Greivenkamp: figure 8, numeral 103); using the phase information to find the orientation of the viewer relative to the fringe pattern generator (Greivenkamp: figure 8, numeral 104); determining the distance to the fringe pattern generator based on the number of fringes in the interference pattern ("measured beat frequency to directly infer the distance"; Greivenkamp: col. 12, lines 20-25); and determining position relative to the fringe pattern generator ("absolute distance ... from a reference position"; Greivenkamp: col. 2, lines 45-50).

Regarding **claim 26**, Greivenkamp teaches an apparatus for determining position, comprising:

a digital processor capable of receiving a digital picture of a fringe pattern from a camera (Greivenkamp: figure 8, numeral 100), the processor adapted to determine the phase of the fringe pattern based on the digital image (Greivenkamp: figure 8, numeral 103), determine the distance

between the camera and the fringe pattern source based on the number of fringes in the pattern, and find the relative position of the camera based on the position of the fringe pattern source (Greivenkamp: figure 8, numeral 104).

Regarding **claim 27**, Greivenkamp teaches a system for determining the position of a vehicle in three dimensions, comprising: a known surface including two generally parallel gratings (Greivenkamp: figures 4-6); a passive detector for detecting interference fringe patterns created by the known surface (Greivenkamp: figure 7, numeral 66); and an image processor which receives the output from the passive detector (Greivenkamp: figure 7, numeral 502) and uses the output to determine the phase of the interference pattern created by the parallel gratings (Greivenkamp: figure 8, numerals 100-104).

Regarding **claim 28**, Greivenkamp teaches a pattern generating navigation aid comprising: a grating assembly associated with a reference location (Greivenkamp: figure 7, numerals 52, 56), which generates a fringe interference pattern upon illumination (Greivenkamp: figure 8, numeral 100), the grating assembly further comprising at least two planar gratings in a fixed spatial relationship to each other (Greivenkamp: figures 4-6); and a source of illumination (Greivenkamp: figure 7, numeral 68).

Regarding **claim 28a**, Greivenkamp teaches a method of determining orientation of an object relative to a reference plane, comprising: mounting a grating assembly at a reference location (Greivenkamp: fig 7, numeral 52, 56), the grating assembly comprising at least two planar gratings in a fixed spatial relationship to each other (Greivenkamp: figures 4-6); illuminating the grating assembly to generate an interference fringe pattern (Greivenkamp: figure 7, numeral 68); imaging the fringe pattern (Greivenkamp: figure 8, numeral 100); measuring the

phase of the fringe pattern with a detector mounted to the object (Greivenkamp: figure 8, numeral 103); and determining the orientation of the object relative to the reference location based on phase measurements (Greivenkamp: figure 8, numeral 104).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. **Claims 7-10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Muller et al (US 5,886,781) in view of Shirley et al (US 2003/0038933 A1).

Regarding **claims 7-10**, Muller discloses all elements as mentioned above in claim 1. Muller does not teach:

a system that includes at least one optical marker to provide a rough estimate of distance and orientation; a optical marker that defines a border around the pattern generator; a system that includes one or more corner markers; and a marker providing reference information for rectification of the fringe patter data.

Shirley teaches:

a system that includes at least one optical marker to provide a rough estimate of distance and orientation (Shirley: figure 6); a optical marker that defines a border around the pattern generator

(Shirley: figure 6); a system that includes one or more corner markers (Shirley: figure 6); and a marker providing reference information for rectification of the fringe pattern data (Shirley: paragraph [0014]-[0015]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Muller reference to include optical markers as suggested by Shirley, to "further increase the accuracy" (Shirley: paragraph [0149]) of the data and to ensure measurement precision.

7. **Claims 11-13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Muller et al (US 5,886,781) in view of Greivenkamp, Jr. et al (US 5,075,562).

Regarding **claims 11-13**, Muller discloses all elements as mentioned above in claim 1. Muller does not teach grating assembly includes portions having different mesh sizes, grating assembly includes a top grating having a smaller mesh size than a bottom grating, and grating assembly includes adjacent portions having different mesh sizes.

Greivenkamp teaches grating assembly includes portions having different mesh sizes (Greivenkamp: fig. 4-6), grating assembly includes a top grating having a smaller mesh size than a bottom grating (Greivenkamp: fig. 4-6), and grating assembly includes adjacent portions having different mesh sizes (Greivenkamp: fig. 4-6).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Muller reference to utilize different size mesh sizes as suggested by Greivenkamp, to further enhance precision and accuracy in the measurements. Furthermore, claims 12-13 are obvious variants of claim 11, which further gives greater accuracy and variation

to the interference pattern obtained by the detector, due to the physical modifications in terms of size.

8. **Claim 17** are rejected under 35 U.S.C. 103(a) as being unpatentable over Greivenkamp, Jr. et al (US 5,075,562) in view of Braunecker et al (US 6,671,058 B1).

Regarding **claim 17**, Greivenkamp discloses all elements as mentioned above in claim 16. Greivenkamp does not teach interference pattern is tracked as the viewer changes in position relative to the fringe pattern generator.

Braunecker teaches an interference pattern is tracked as the viewer changes in position relative to the fringe pattern generator (Braunecker: figure 5, numerals 9a-c).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Greivenkamp reference to utilize different positions for the viewer as suggested by Braunecker, "for reasons of redundancy and because of the possible concealment of the object structures" (Braunecker: col. 10, lines 66-67).

9. **Claim 18** is rejected under 35 U.S.C. 103(a) as being unpatentable over Greivenkamp, Jr. et al (US 5,075,562) in view of Larkin et al (US 7,043,082 B2).

Regarding **claim 18**, Greivenkamp discloses all elements as mentioned above in claim 16. Greivenkamp does not teach a likelihood estimation algorithm is used by the processor to lift the integer ambiguity.

Larkin teaches a likelihood estimation algorithm is used by the processor to lift the integer ambiguity (Larkin: figure 19, numerals 690, 692, 694).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Greivenkamp reference to utilize a estimation algorithm as suggested by Larkin, to increase accuracy and precision of the measurements of the system.

10. **Claims 19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Greivenkamp, Jr. et al (US 5,075,562) in view of Taylor et al (US 5,967,979).

Regarding **claim 19**, Greivenkamp discloses all elements as mentioned above in claim 16. Greivenkamp does not teach determining the position of a horizon line in the image.

Taylor teaches determining the position of a horizon line in the image (Taylor: figure 4).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Greivenkamp reference to determine the position of a horizon as suggested by Taylor, to implement reference points for the system to utilize in determining other respective points.

11. **Claims 20-25** are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Greivenkamp, Jr. et al (US 5,075,562) with Larkin et al (US 7,043,082 B2) as applied to claim 18 above, and further in view of Taylor et al (US 5,967,979).

Regarding **claims 20-25**, Greivenkamp with Larkin combination discloses all elements as mentioned above in claim 18. Greivenkamp with Larkin combination does not teach determining the location of nadir in the image captured by the viewer, the processor determining the angular coordinates on the image plane, the equations yc = ..., xc = ..., h= .. are solved by the processor and xc, yc, and h are used to correct the orientation of the reference target so that it is viewed in actual dimensions, the corrected image used to determine phase information, and the equations are used to estimate position data.

Taylor teaches determining the location of nadir in the image captured by the viewer (Taylor: figure 4), the processor determining the angular coordinates on the image plane (Taylor: figure 4), the equations yc = ..., xc = ..., h= .. are solved by the processor and xc, yc, and h are used to correct the orientation of the reference target so that it is viewed in actual dimensions (col. 9, lines 40-58), corrected image used to determine phase information (col. 10, lines 20-25), and the equations are used to estimate position data (col. 9, lines 40-58).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Greivenkamp reference to determine the location of nadir, angular coordinates, solve equations, correct orientation, determine phase information, and estimate position as suggested by Taylor, to compute the location of the "focal center" (Taylor: col. 9, lines 49-50), "rotation angle" (Taylor: col. 9, lines 34-39), "x', y' coordinates system" (col. 9, lines 42-45), phase information, and estimate position data of the target object that the system is designed to calculate with greater accuracy and precision. Furthermore, it would have been obvious to one ordinary skill in the art to calculate the three distances yc, xc, and h utilizing well known trigonometric distance equations as done in the Taylor reference.

The Greivenkamp, Larkin, and Taylor combination does not teach to resolve integer ambiguity using position data (as applied in claim 18). However, it would have been obvious to one ordinary skill in the art to resolve integer ambiguity as taught by Larkin using the position data of Taylor, to increase accuracy and precision of the measurements of the system.

12. **Claims 29-34** are rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor et al (US 5,967,979) in view of Greivenkamp, Jr. et al (US 5,075,562).

Regarding **claims 29, 33, 34**, Taylor teaches a method of determining location of an object relative to a reference location (Taylor: figure 4), comprising identifying a source associated with a reference location (Taylor: figure 4), the source generating an interference fringe pattern (Taylor: figure 4), extracting geometric information from the source (Taylor: figure 8), rectifying an image of the fringe pattern based on the geometric information (Taylor: figure 4), determining the location of the object relative to the reference location based on the geometric information (Taylor: figure 4).

Taylor does not teach determining the location of the object relative to the reference location based on the phase measurements, refining a distance measurement based on a measurement of fringe spacing, and refining an estimate of orientation of the object relative to source based on phase changes in the fringe pattern over time.

Greivenkamp teaches determining the location of the object relative to the reference location based on the phase measurements (Greivenkamp: figure 9, numeral 103), refining a distance measurement based on a measurement of fringe spacing (Greivenkamp: figure 9, numeral 103-104), and refining an estimate of orientation of the object relative to source based on phase changes in the fringe pattern over time (Greivenkamp: figure 9, numerals 201-202).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Taylor reference to utilize the phase measurements, refine distance measurement, and refine estimate of orientation as suggested by Taylor, to increase the accuracy and precision of determining the position and orientation of the object since utilizing two different measurements is generally more accurate than one.

Regarding **claim 30**, Taylor teaches estimating an altitude of the object relative to source based on geometric data (Taylor: figure 4).

Regarding **claim 31**, Taylor teaches estimating an angular orientation of the object relative to a plane defined by the source based on geometric data (Taylor: figure 4).

Regarding **claim 32**, Taylor teaches estimating distance based on the geometric data (Taylor: figure 4-5).

13. **Claim 35** is rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor et al (US 5,967,979) with Greivenkamp, Jr. et al (US 5,075,562) as applied to claim 29 above, and further in view of Larkin et al (US 7,043,082 B2).

Regarding **claim 35,** Taylor with Greivenkamp combination discloses all elements as mentioned above in claim 29. Taylor with Greivenkamp combination does not teach a weighting function being applied to at least one of the geometric or phase measurements over time.

Larkin teaches a weighting function being applied to at least one of the geometric or phase measurements over time (Larkin: figures 690, 692, 694).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Taylor with Greivenkamp combination to utilize a weighting function as suggested by Larkin, to increase accuracy and precision of the measurements of the system.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edward Park whose telephone number is (571) 270-1576. The examiner can normally be reached on M-F 09:00-17:00, (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Werner can be reached on (571) 272-7401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Edward Park
Examiner
Art Unit 2609

EP 4/26/07

BRIAN WERNER
SUPERVISORY PATENT EXAMINER